

RETROSPECTIVE IMMUNIZATION COVERAGE SURVEY

1999-2000 Results (School Year 2003-04)

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ACRONYMS

4-3-1 Combination	DTP4-Polio3-MMR1
AAFP	American Academy of Family Physicians
AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practices
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
DTP4	4 doses of diphtheria, tetanus, and pertussis vaccine
HEPB3	3 doses of hepatitis B vaccine
HIB3	3 doses of <i>Haemophilus influenzae</i> type b
KCI	Kansas Certificate of Immunization
KDHE	Kansas Department of Health and Environment
MMR1	1 dose of measles, mumps, and rubella vaccine
MMWR	Morbidity and Mortality Weekly Report
NIS	National Immunization Survey
Polio3	3 doses of polio vaccine
VAR1	1 dose of varicella vaccine

RETROSPECTIVE IMMUNIZATION COVERAGE SURVEY 1999-2000 (SCHOOL YEAR 2003-2004)

EXECUTIVE SUMMARY

The Kansas Immunization Certificates (KICs) for children five-years of age enrolled in a kindergarten class in a Kansas public school during the 2003-2004 school year were collected and evaluated for immunization coverage rates. The children included in this survey were born between September 2, 1997, and September 1, 1998, and the coverage rates refer to when they were two years old, which was between September 2, 1999, and September 1, 2000.

Immunization coverage rates were also calculated for these children at 5 years of age. The results for this survey were measured against similar previous studies. Seven hundred and eleven schools were included in the analysis. The 9,652 KICs were a representative sample of the five-year old enrolled kindergarten at a public school.

The statewide coverage rate for the 4-3-1 combination (that is, DTP4, Polio3, MMR1) was 79%. Even though not required for school entry, over half (55.8%) of the children were vaccinated for VAR1 and this is a statistically significant increase compared to the 46.8% in previous survey. Statistically significant decreases in coverage rates were observed for HepB3.

Peer groups of counties were regrouped from 5 categories to 3. Mean coverage rate estimates were compared among these groups. Counties that were “sparsely populated” had higher mean coverage rates than counties with greater population densities except for VAR1 (Moderately populated, Urban).

At 4 months of age, 93% of the children were up-to-date for immunizations. However, as the child’s age increased, the coverage rates decreased. Immunization coverage rates declined by almost 20 percentage points between 4 and 8 months of age. After 8 months of age, immunization coverage rates began to increase until they reached 79% at 2 years of age.

Overall, Kansas immunization coverage rates of children by two years of age for the 4-3-1 combination have steadily increased from 57% in 1990-1991 school year to 79% in 2003-2004 school year. Continued assessment and evaluation of the immunization rates are necessary to monitor progress toward the Healthy Kansas 2010 goal of 90% immunization coverage.

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INTRODUCTION

Objective

To estimate the immunization coverage rates at the age of two years for children enrolled in the Kansas public school system during the 2003-04 school year.

Study Population

The study population included all children enrolled in kindergarten in the Kansas public school system during the 2003-2004 school year.

Study Design

The study was a stratified, cross-sectional survey, with each county representing a stratum. The characteristics of interest, or outcome variables, were the percentage of children who were fully immunized at two years of age against the diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, *H. influenza*, hepatitis B virus, and varicella. Also, this was the first year to examine immunization coverage rates at five years of age.

Immunization coverage rates were measured for single vaccines and combinations of vaccines according to the recommended immunization schedule for children two years of age.¹ *The results of the survey refer to children who were born between September 2, 1997, and September 1, 1998. The coverage rates refer to the time these children were two-years-old, which is between September 2, 1999, and September 1, 2000 as well as coverage rates at five years of age when first entering school.*

Similar studies have been performed every year since 1990, except for the 1991-92 school year. Confidence intervals (CI) have been calculated since the 1994-95 school year.

METHODS

Sampling Techniques

The survey relied on a probability sample of children enrolled in all Kansas public schools with a kindergarten class. To ensure an adequate sample size in each county while maximizing the efficiency of the sampling process, a different sampling ratio was established for each county, and a probability sample was selected using a systematic sample technique.²

Data Collection

¹ The Recommended Immunization Schedule used, as reference for ages and immunization in this paper was the schedule approved by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP) and the American Academy of Family Physicians (AAFP) for the year 1995.

² The sample ratio is the ratio between the total enrollment in a school and the sample size, and it represents the proportion of enrolled children who are sampled.

All Kansas public schools with a kindergarten class received a letter co-signed by the Kansas Department of Health and Environment and Kansas Department of Education, requesting them to participate in the survey. The letter specified the number of records required to generate estimates of county-specific coverage rates (i.e., sample size) and outlined the process of systematically selecting a probability sample of records. Depending on the calculated sampling ratio for their county, each school was instructed to select all, every other, every third, every sixth, every fourteenth, or every sixteenth immunization record regardless of the size of the kindergarten class at that school. School administrators and school nurses were also advised to remove all personal identifiers, except date of birth, to ensure confidentiality of children. Copies of the immunization records and the current total number of kindergarten enrollees in each school were forwarded to KDHE.

Data Analysis

Point estimates of coverage rates and 95% confidence intervals (95% CI) for DTP4, Polio3, MMR1, 4-3-1 combination, HIB3, HEPB3, and VAR1 vaccines were calculated. A child was considered “up-to-date” for single vaccines if, at age two years, he or she had received at least four doses of DTP, (DTP4), three doses of Polio (Polio3), one dose of MMR (MMR1), three doses of *H. influenza* type b (HIB3), three doses of Hepatitis B (HEPB3), and one dose of the varicella (VAR1) vaccine. A child was considered “up-to-date” for the 4-3-1 combination antigen if he or she was up-to-date for all: DTP4, Polio3, and MMR1 vaccines. The statewide estimates took into consideration the complex survey design effect due to the stratification process and to the differences in sampling ratios among counties.³

The rates from the 2002-03 and 2003-04 school year surveys were compared. Differences between estimates were considered significant if the 95% CI of the current year did not overlap with the 95% CI of the previous year.

Population densities are used from the 2001 Annual Summary of Vital Statistics to categorize counties.⁴ These categories include Urban, Semi-Urban, Densely-Populated, Rural, and Frontier. For the purpose of this analysis, these categories are regrouped into Urban (Urban), Moderately Populated (Semi-Urban, Densely-Populated) and Sparsely-Populated (Rural, Frontier). Mean immunization coverage rate estimates were compared among these groups (Appendix 1).

Coverage rates were also calculated at 4, 6, 8, 17, and 20 months of age. Each goal point coincides with a point two months after the end of the recommended age for administration of an immunization. For example at 2 months of age DTP1 and Polio1 are recommended. Therefore in order to include the two-month “grace period,” children are evaluated at 4 months of age for receipt of DTP1 and Polio1. The 4 month and 24 months goal points were used to assess the children that start their immunization series either on time or late and those who finish either on time or late. Finally, immunization coverage rates were calculated for this group of children at the time of their enrollment in kindergarten, that is, at the age of 5 years.

³Complex survey design effect was accounted for by using the SAS Procedure PROC SURVEYMEANS.

⁴ <http://www.kdhe.state.ks.us/hci/as01/as2001.html>

RESULTS

Letters of invitation to participate in the survey were sent to 761 Kansas public schools. Fourteen schools reported not having a kindergarten class for the 2003-2004 school year and 36 did not respond. Data were received from and analyzed for 711 schools with kindergarten classes.

The number of children enrolled in kindergarten at the participating public schools was 32,346, which represents 84% of the 38372 children in that birth cohort.⁵ Approximately 16% of the birth cohort was not represented. Those not represented include children who attend private school, home school or other special schools. The number of immunization records received was 12,357. This is equivalent to a sampling ratio of 2.6, meaning that one child was selected for every 2.6 children enrolled. The sample size by county ranged from 15 to 369 records while enrollment ranged from 18 to 5,726.⁶

Of the 12,357 immunization records returned and examined, 9,652 (78%) were complete and had usable information of immunization history. This included children who were at least five years of age but less than six years of age on September 1, 2003. Of the 2705 children excluded, 1445 (53%) were not 5 years of age. The remaining records excluded had incomplete or unusable KCIs. For the population density categories, 3365 (35% of all records) for Sparsely-populated, 4693 (49% of all records) for Moderately-populated and 1594 (16% of all records) for Urban were examined.

The immunization coverage rates for the all of the single vaccines and the 4-3-1 combination remained the same or increased compared to the coverage rates of the previous year except for VAR1. As seen in Table 1 coverage rates for VAR1 rose 9 percentage points from 46.8% to 55.8% in just one year even though it is not required for school entry. Coverage rates remain high for HIB3 and HEPB3 even though they are also not required for school entry. Immunization coverage rates have risen each year from 1990-91 through 1999-2000 as displayed in Figure 1.

⁵1998 Annual Summary of Kansas Vital Statistics.

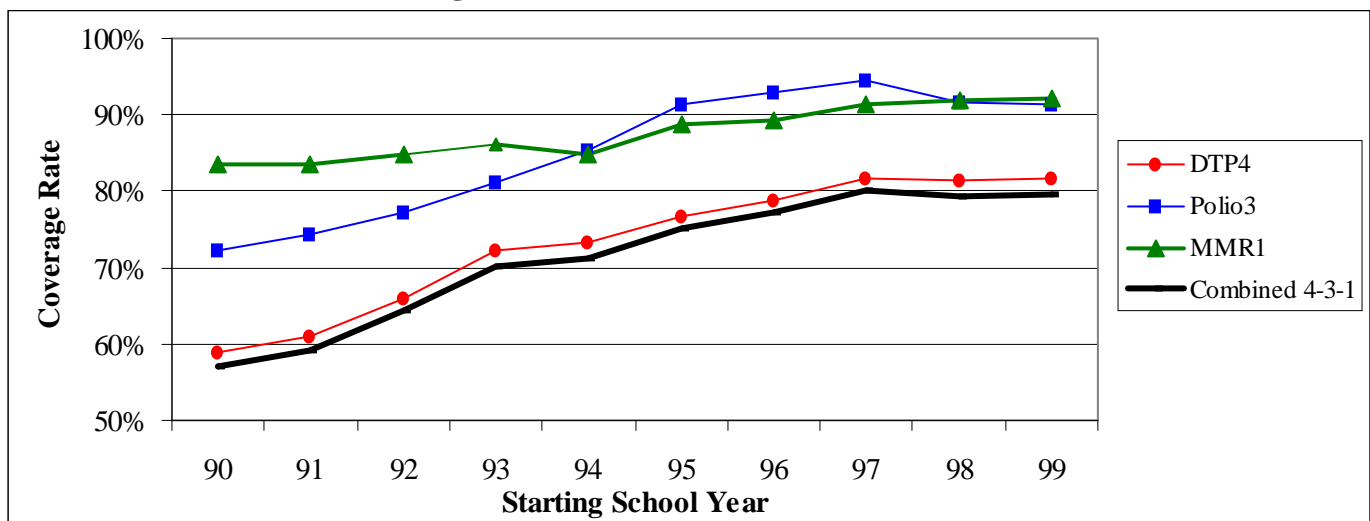
⁶Estimates from counties with small sample size (<50) may be unstable and changes over time should be interpreted with caution.

TABLE 1 Kansas immunization coverage rates at the age of 2 years by vaccine from 1997-98 through 1999-2000. * Percentage up-to-date and 95% confidence interval

	1997-98		1998-99		1999-2000	
	%	95% CI	%	95% CI	%	95% CI
DTP4	81.6	80.4 - 82.8	81.5	80.3 - 82.7	81.6	80.3 - 82.7
Polio3	94.5	93.8 - 95.2	91.5	90.6 - 92.5	91.4	90.6 - 92.5
MMR1	91.3	90.4 - 92.1	92.0	91.1 - 92.8	92.1	91.1 - 92.8
Combined 4-3-1	80.2	78.9 - 81.4	79.3	78.0 - 80.6	79.5	78.0 - 80.6
HIB3	82.3	81.2 - 83.5	83.9	82.8 - 85.1	84.6	82.8 - 85.1
HEPB3	87.5	86.5 - 88.6	90.4	89.5 - 91.3	88.0	89.5 - 91.3
VAR1	34.0	32.4 - 35.5	46.8	45.2 - 48.3	55.8	45.2 - 48.3

*Based on retrospective surveys from school years starting in 2001, 2002, and 2003.

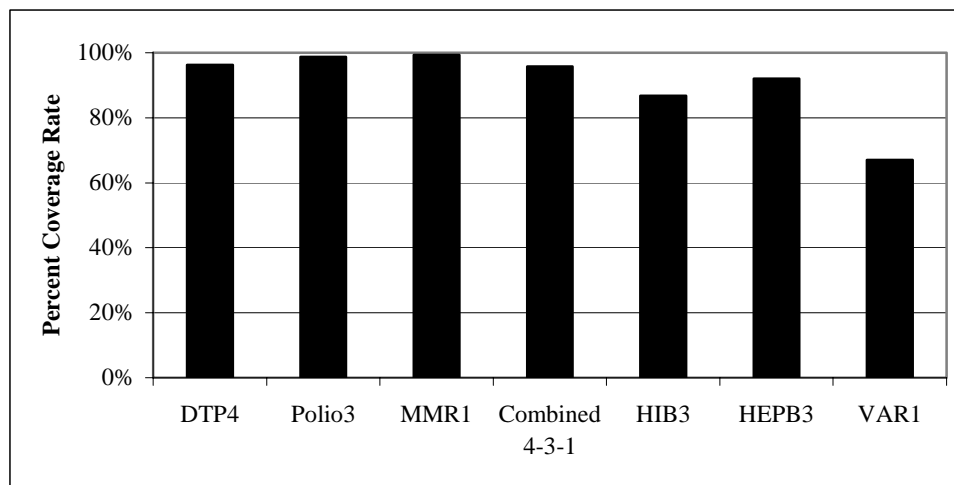
FIGURE 1 Kansas immunization coverage rates at the age of 2 years by vaccine from 1990-91 through 1999-2000. *



* Based on retrospective surveys from school years starting in 1994 through 2003.

Immunization rates of kindergarteners when they were five years old were also calculated (Figure 2). By age 5, at least 95% of the children are up-to-date for DTP4, Polio3, MMR1, and the 4-3-1 combination, and two-thirds of the children are up-to-date for VAR1. The greatest increases of coverage rates for single vaccines were for DTP4 and VAR1, which increased by 14.8 and 11.3 percentage points, respectively. These data show those immunization rates are higher when children are about to enter school than at the age of 2 years.

FIGURE 2 Immunization rates of Kansas kindergartners at age five years, 2003-04. *



*Based on the retrospective survey for the school year starting 2003.

Up-to-date coverage rates at 4, 6, 8, 17, and 20 months were assessed for DTP, Polio, and MMR (Table 2, Figure 3). For reference, the coverage rates at 24 months have also been included. At 4 months of age at which only DTP1 and Polio1 are required, immunization coverage rates were at 93%. As the number of immunizations required to be up-to-date increased, coverage rates decreased.

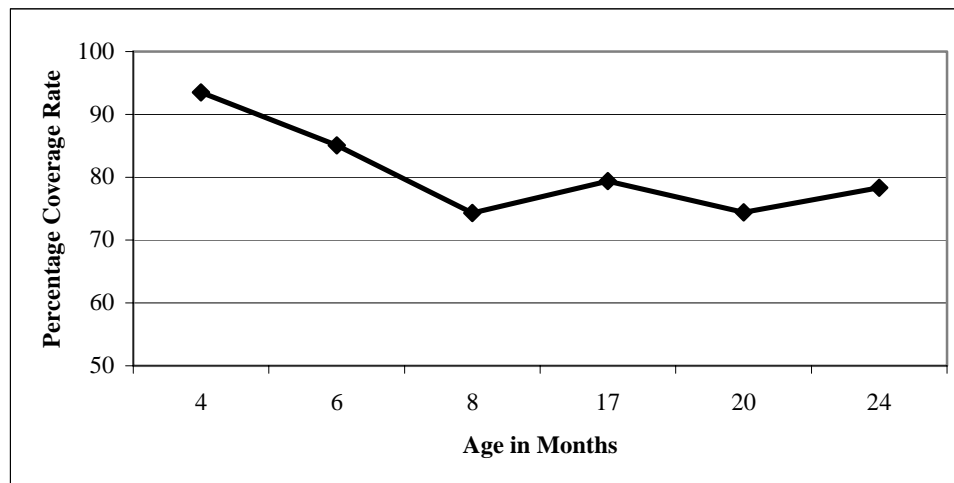
TABLE 2 Percentage coverage rates at 4,6,8,17,20, and 24 months of age for Kansas in 1998-99 through 1999-2000. *

Goal Point (Age)	School Required Vaccines	1998-1999	1999-2000
4 months	DTP1 , Polio1	94.3	93.5
6 months	DTP2 , Polio2	84.4	85.1
8 months	DTP3 , Polio2	73.3	74.3
17 months	DTP3 , Polio2, MMR1	78.6	79.4
20 months	DTP4 , Polio3, MMR1	74.5	74.4
24 months	DTP3, Polio3, MMR1	79.3	78.3

* Based on retrospective surveys from school years starting in 2002 and 2003.

Vaccines in bold type denote new vaccine for that time interval.

FIGURE 3 Coverage rates at 4,6,8,17,20, and 24 months of age for Kansas in 1999-2000. *

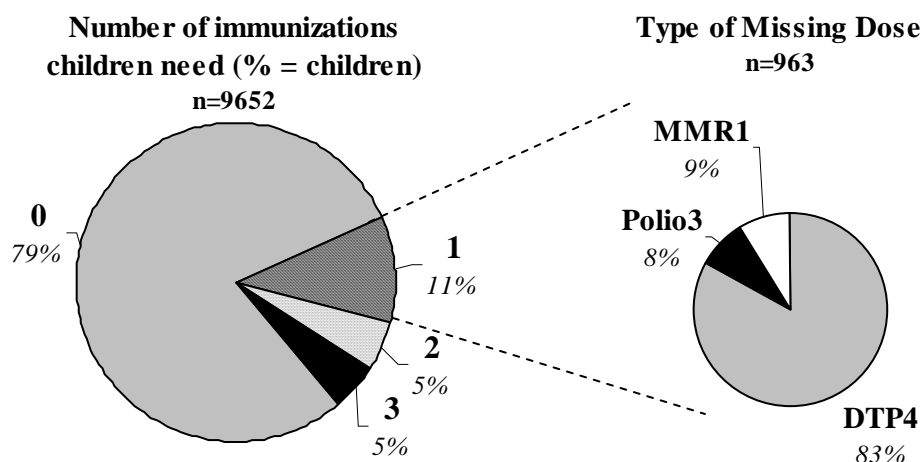


* Based on the retrospective survey for the school year starting 2003.

Of the 9023 children in the sample who were up-to-date at 4 months of age, 7510 (83%) were still up-to-date at 24 months of age. Of the 629 children who were late at 4 months, only 220 (35%) caught up and were up-to-date at 24 months of age. This means that 65% of the children who are not up-to-date at 4 months of age do not catch up before 24 months and children who start on time are 123% (relative risk ratio 2.23) more likely complete the 4-3-1 immunization series on time by 24 months of age compared to those children who do not begin the series on time.

Of the children not up-to-date at 24 months of age, 50% (10% of total population studied) needed one additional immunization in order to be up-to-date (Figure 4). If these children had received one additional immunization the coverage rates for the 4-3-1 combination would have increased from 78.5% to 90.3%. For those children needing one additional immunization, 83.0% needed DTP4, 8.4% needed Polio3, and 8.6% needed MMR1.

FIGURE 4: Number and type of immunizations kindergarteners needed to be up-to-date at the age of 24 months, Kansas 1999-2000. *



*Based on the retrospective survey for the school year starting 2003.

Median and range of coverage rates of counties were compared. The median values for the coverage rates among the counties have remained the same for the 4-3-1 combination and single vaccines except VAR1. Half of the counties have 54% coverage rates for VAR1. This is an increase in the VAR1 median from last year, which was only 42%. Polio3, MMR1, HIB3, and HEP3 all have median values greater than 90%. Coverage rates varied greatly for HIB3 (37-100%) and VAR1 (8-100%). Appendix 2 shows the coverage rates by county for the single vaccines and 4-3-1 combination.

Counties were categorized together based on their population densities. Estimated mean coverage rates of the counties were compared among three categories (Table 3). Compared to the estimated mean coverage rates of the other two groups of counties, the estimated mean coverage rate for the “sparsely populated” category was highest for the 4-3-1 combination and all vaccines except VAR1.

TABLE 3: Mean Immunization Coverage Rate Estimates (%) Among Categories Based on Population Density.

Counties by Population Density - Collapsed Groups			
	Sparsely Populated (n=70)	Moderately Populated (n=29)	Urban (n=6)
DTP4	85.3	80.3	81.0
Polio3	92.7	90.4	91.1
MMR1	93.8	90.8	92.0
Combined 4-3-1	83.8	78.5	78.3
HIB3	90.1	83.5	84.0
HEPB3	91.8	89.3	86.7
VAR1	52.7	49.9	57.7

DISCUSSION

Statewide immunization coverage rates remained at current levels in the 2002-2003 retrospective survey except VAR1 which had an increase of 9 percentage points compared to last year's retrospective survey. Since the children were five years old when this study was carried out, the results of the survey indicate the immunization coverage rates that were effective about three years earlier. Immunization coverage rates in Kansas for Polio3 and MMR1 have reached the Healthy People 2010 (HP2010) goal.⁷ DTP4 and HIB3 are less than 10 percentage points from meeting this goal. Immunizations against hepatitis B (HEPB3), *H. influenza* (HIB3), and varicella (VAR1) were not required for school entry for the 2003-2004 school year and thus not always recorded in the KCI. For this reason the immunization coverage rates might actually be higher than presented. Also history of varicella disease was not examined. Including children who have had history of varicella disease and do not need to be vaccinated for varicella would also underestimate the vaccination rate.

Immunization coverage rates were also examined of the kindergarteners when they were five years old. By age 5, immunization coverage rates increase for all single vaccines. At least 95% of the children have received DTP4, Polio3 and MMR1, and two-thirds of the children have received VAR1. School entry requirements are the most likely reason for this increase, although coverage rates for non-required vaccines increased also.

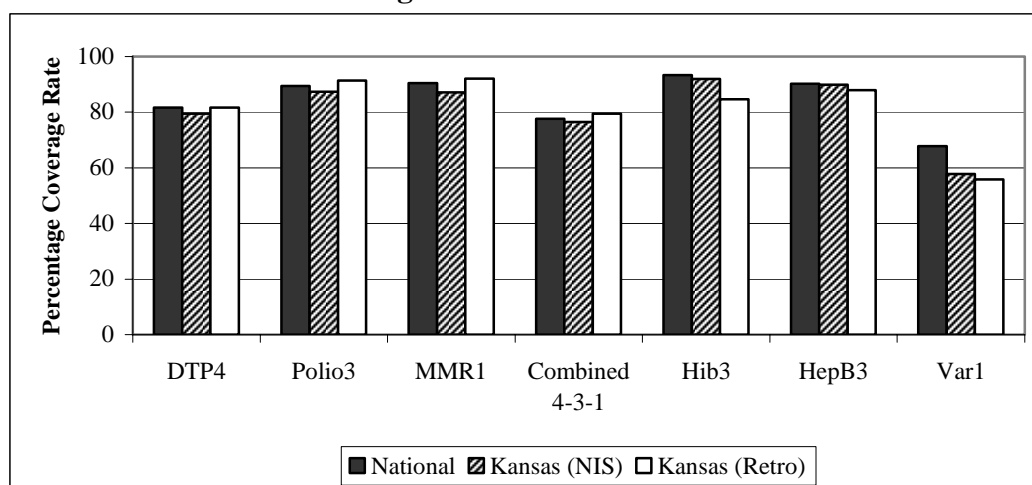
County designations were used to create categories by population. The mean coverage rate estimates were compared to determine if differences exist among the counties of different population densities. Compared to the mean coverage rate estimates of the other two categories (moderately populated, urban), the mean coverage rate estimate for the "sparsely populated" category was highest for the 4-3-1 combination and all vaccines except VAR1 in which "urban" had the greatest mean coverage rate. "Urban", which includes the most densely populated counties and represent 51% of the population, had the lowest coverage rate estimates for the 4-3-

⁷Healthy People 2010 set goals of 90% coverage for DTP4, Polio3, MMR1, HIB3, HEPB3, and VAR1 among children aged 19 to 35 months.

1 combination and HepB3. Targeting the population in the 5 “urban” counties in order to increase coverage rate estimates would have a positive affect on the statewide coverage rate.

The results from this survey were compared with the results from the 2000 National Immunization Survey (NIS), which refers to the same time period in this retrospective survey (Figures 5, 6).⁸ The results were compared to confirm the coverage rates in the retrospective survey and to compare coverage rates in Kansas to the rest of the US. Data for the population-based NIS were collected by the Centers for Disease Control and Prevention (CDC) through a telephone survey of randomly selected households. For accuracy, the healthcare providers (family physicians, pediatricians, etc.) of the children included in the survey were contacted by mail. The coverage rates for HIB3 and VAR1 were significantly lower in the Retrospective survey when compared to the NIS results for Kansas. Possible reasons for the difference in rates are that neither HIB3 nor VAR1 are required for school entry, they may not be routinely recorded on the KCIs, and differences in sampling methodologies.

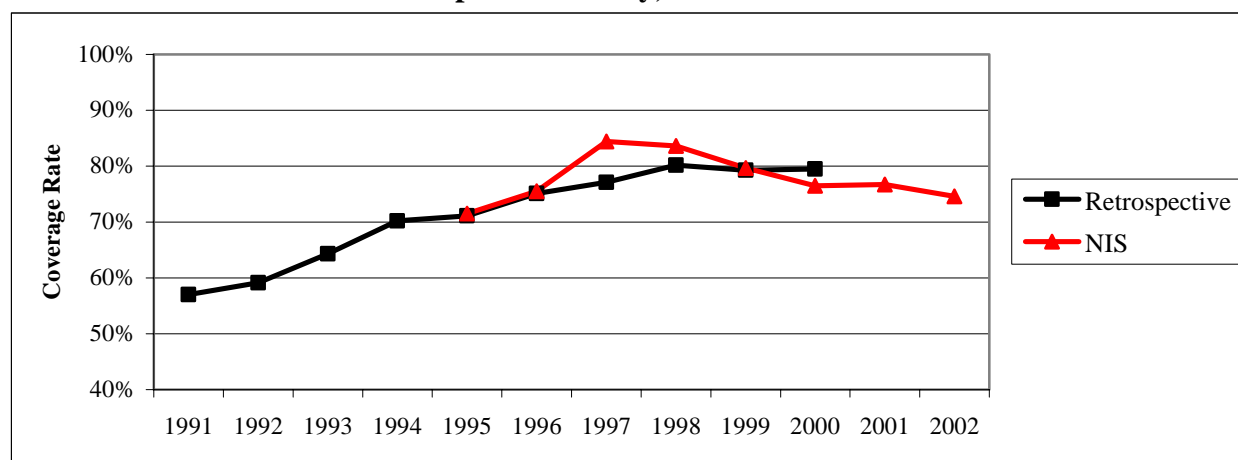
FIGURE 5 Immunization Coverage Rates for the United States and Kansas. 1999-2000.*



National and Kansas (NIS) rates were estimated by the National Immunization Survey 2000 and the Kansas (Retro) rates were estimated by the Retrospective Immunization Coverage Survey (1999-2000).

⁸ *Morbidity and Mortality Weekly Report*; 50 (30); 637-641.

FIGURE 6: Comparison of Immunization Coverage Rates for the 4-3-1 from the Kansas NIS and the Retrospective Survey, 1991-2002.



Only, 79.5% of all children were up-to-date for the 4-3-1 combination at 24 months of age. Of the children not up-to-date at 24 months of age, 50% (10% of total population studied) needed one additional immunization in order to be up-to-date. For those children not up-to-date at 24 months of age, it is likely that an opportunity to administer all immunizations was missed. If those children missing just one immunization had received it, then statewide immunization coverage rates for the 4-3-1 combination would have increased from 79.5% to 90.3%.

Limitations

Limitations of this survey include: the survey reports data that refers to immunization coverage rates that occurred three years before the survey. The retrospective immunization survey only included children who were enrolled in kindergarten in a Kansas public school. Children who attended a private school or are home-schooled were excluded from the survey. However, the records analyzed are representative of 83% of this birth cohort, which is likely to ensure their validity. Also, no descriptive data were collected about race, ethnicity, or religious and medical exemptions.

Strengths

Despite the limitations, the retrospective immunization survey provides a good estimation of the immunization coverage rates for Kansas. It allows state and local officials to identify and focus on the counties with low coverage rates. Recognition and focus on problem areas such as age and location can aid in Kansas achieving the 90% coverage rate goal. To this purpose, a similar survey is planned to be repeated next year.

APPENDIX 1: Kansas counties grouped together based on population density.

SPARSELY POPULATED		MODERATELY POPULATED	URBAN
Anderson	Mitchell	Allen	Douglas
Barber	Morris	Atchison	Johnson
Brown	Morton	Barton	Leavenworth
Chase	Nemaha	Bourbon	Sedgwick
Chautauqua	Ness	Butler	Shawnee
Cheyenne	Norton	Cherokee	Wyandotte
Clark	Osborne	Cowley	
Clay	Ottawa	Crawford	
Cloud	Pawnee	Dickinson	
Coffey	Phillips	Ellis	
Comanche	Pratt	Finney	
Decatur	Rawlins	Ford	
Doniphan	Republic	Franklin	
Edwards	Rice	Geary	
Elk	Rooks	Harvey	
Ellsworth	Rush	Jefferson	
Gove	Russell	Labette	
Graham	Scott	Lyon	
Grant	Sheridan	McPherson	
Gray	Sherman	Miami	
Greeley	Smith	Montgomery	
Greenwood	Stafford	Neosho	
Hamilton	Stanton	Osage	
Harper	Stevens	Pottawatomie	
Haskell	Thomas	Reno	
Hodgeman	Trego	Riley	
Jackson	Wabaunsee	Saline	
Jewell	Wallace	Seward	
Kearny	Washington	Sumner	
Kingman	Wichita		
Kiowa	Wilson		
Lane	Woodson		
Lincoln			
Linn			
Logan			
Marion			
Marshall			
Meade			

APPENDIX 2: Immunization Coverage Rates for Kansas Counties 1999-2000.*

COUNTY	DTP4	Polio3	MMR1	Combined 4-3-1	Hib3	HepB3	Var1
ALLEN	81.6	95.6	93.9	80.7	93.9	91.2	48.2
ANDERSON	81.4	89.2	91.2	78.4	94.1	90.2	61.8
ATCHISON	83.5	90.1	90.1	80.2	89.3	83.5	28.1
BARBER	80.6	94.4	91.7	80.6	94.4	91.7	38.9
BARTON	94.4	97.2	97.2	91.7	97.2	94.4	72.2
BOURBON	81.3	88.9	91.0	78.5	94.4	93.1	54.2
BROWN	81.6	89.5	86.8	73.7	36.8	84.2	7.9
BUTLER	84.5	92.5	93.2	83.8	89.8	92.8	51.7
CHASE	83.3	96.7	96.7	83.3	96.7	100.0	30.0
CHAUTAUQUA	88.6	94.3	100.0	88.6	97.1	100.0	48.6
CHEROKEE	73.5	89.0	90.6	73.5	89.0	91.7	33.1
CHEYENNE	88.0	92.0	92.0	84.0	84.0	96.0	40.0
CLARK	68.0	80.0	92.0	64.0	92.0	92.0	56.0
CLAY	84.8	92.4	92.4	82.3	86.1	92.4	63.3
CLOUD	91.2	97.1	97.1	91.2	63.2	92.6	42.6
COFFEY	75.8	80.8	82.8	74.7	85.9	85.9	39.4
COMANCHE	100.0	100.0	100.0	100.0	94.4	94.4	88.9
COWLEY	77.7	89.1	87.5	75.5	52.2	92.4	31.0
CRAWFORD	70.5	86.3	87.9	69.5	87.9	85.8	29.5
DECATUR	88.9	100.0	94.4	88.9	100.0	100.0	27.8
DICKINSON	86.4	95.5	91.8	85.5	88.2	95.5	51.8
DONIPHAN	78.3	88.0	91.6	78.3	88.0	84.3	32.5
DOUGLAS	88.2	94.9	95.4	86.9	94.1	92.0	64.6
EDWARDS	90.9	100.0	100.0	90.9	93.9	90.9	66.7
ELK	85.7	92.9	92.9	82.1	92.9	96.4	53.6
ELLIS	89.1	95.5	97.3	88.2	90.0	90.9	56.4
ELLSWORTH	92.5	98.1	98.1	90.6	98.1	94.3	58.5
FINNEY	80.1	90.1	86.1	78.1	87.4	89.4	61.6
FORD	72.8	87.5	87.9	71.6	79.4	82.5	50.6
FRANKLIN	64.8	79.2	87.2	62.4	84.8	85.6	60.0
GEARY	78.1	86.8	89.5	72.8	91.7	90.4	63.2
GOVE	77.8	83.3	83.3	77.8	94.4	83.3	44.4
GRAHAM	81.8	90.9	95.5	77.3	95.5	90.9	59.1
GRANT	81.8	92.4	91.7	81.1	85.6	87.1	62.9
GRAY	78.0	95.1	90.2	78.0	85.4	87.8	61.0
GREELEY	93.3	86.7	93.3	86.7	93.3	93.3	73.3
GREENWOOD	76.7	87.2	88.4	75.6	87.2	87.2	41.9
HAMILTON	81.1	91.9	89.2	78.4	78.4	81.1	48.6

* Based on the retrospective survey for the school year starting 2003.

COUNTY	DTP4	Polio3	MMR1	Combined 4-3-1	Hib3	HepB3	Var1
HARPER	80.0	86.7	93.3	73.3	93.3	96.7	66.7
HARVEY	81.2	89.9	89.4	77.5	78.9	81.7	52.3
HASKELL	83.3	87.0	92.6	81.5	92.6	88.9	70.4
HODGEMAN	76.2	90.5	90.5	76.2	95.2	100.0	76.2
JACKSON	87.4	94.1	94.1	85.7	77.3	83.2	21.0
JEFFERSON	81.7	90.1	90.1	77.5	88.7	88.7	64.1
JEWELL	84.2	84.2	89.5	84.2	78.9	84.2	52.6
JOHNSON	89.4	95.9	95.9	87.0	79.4	85.4	67.2
KEARNEY	88.9	94.4	88.9	85.2	94.4	87.0	50.0
KINGMAN	87.9	94.8	98.3	87.9	94.8	94.8	56.9
KIOWA	80.6	90.3	93.5	80.6	90.3	83.9	48.4
LABETTE	68.2	79.8	82.2	66.7	48.8	92.2	58.9
LANE	100.0	100.0	100.0	100.0	100.0	100.0	84.2
LEAVENWORTH	77.4	85.8	85.8	71.6	77.4	84.2	52.6
LINCOLN	86.2	93.1	96.6	79.3	96.6	96.6	44.8
LINN	73.2	88.4	87.5	72.3	93.8	89.3	52.7
LOGAN	85.2	88.9	92.6	85.2	88.9	96.3	37.0
LYON	86.5	91.6	92.6	86.0	91.2	90.7	45.1
MARION	90.3	94.2	98.1	87.4	87.4	88.3	16.5
MARSHALL	82.9	92.9	91.4	81.4	92.9	95.7	31.4
MCPHERSON	87.7	95.1	95.7	87.7	77.8	90.7	65.4
MEADE	80.0	85.7	85.7	77.1	85.7	88.6	60.0
MIAMI	78.8	92.9	92.9	77.8	90.9	87.9	49.5
MITCHELL	90.6	96.2	96.2	88.7	98.1	96.2	39.6
MONTGOMERY	75.0	83.7	87.5	72.1	75.0	85.6	67.3
MORRIS	85.7	91.1	89.3	83.9	92.9	94.6	55.4
MORTON	80.5	92.7	92.7	73.2	90.2	92.7	63.4
NEMAHA	89.4	97.0	95.5	88.6	96.2	94.7	18.9
NEOSHO	82.7	91.3	93.1	81.5	94.2	90.8	11.0
NESS	80.0	93.3	90.0	80.0	93.3	100.0	83.3
NORTON	87.7	96.9	96.9	87.7	90.8	96.9	56.9
OSAGE	84.1	96.2	92.4	82.8	74.5	88.5	46.5
OSBORNE	70.6	82.4	88.2	70.6	82.4	82.4	52.9
OTTAWA	90.6	94.3	94.3	88.7	94.3	96.2	37.7
PAWNEE	88.5	98.1	98.1	88.5	94.2	92.3	80.8
PHILLIPS	85.7	95.2	97.6	81.0	97.6	92.9	61.9
POTTAWATOMIE	85.6	93.9	95.6	84.5	91.2	91.7	54.1
PRATT	93.6	98.7	98.7	93.6	94.9	96.2	37.2

*Based on the retrospective survey for the school year starting 2003.

COUNTY	DTP4	Polio3	MMR1	Combined 4-3-1	Hib3	HepB3	Var1
RAWLINS	75.0	87.5	93.8	75.0	81.3	81.3	56.3
RENO	81.7	93.9	94.8	79.8	90.1	85.4	60.6
REPUBLIC	90.2	95.1	95.1	87.8	92.7	92.7	53.7
RICE	85.4	95.1	98.8	84.1	79.3	86.6	64.6
RILEY	81.1	91.1	91.7	78.9	56.1	91.7	54.4
ROOKS	92.5	97.5	100.0	92.5	100.0	95.0	75.0
RUSH	95.2	95.2	95.2	95.2	100.0	100.0	38.1
RUSSELL	85.5	95.2	91.9	83.9	91.9	90.3	54.8
SALINE	77.5	89.6	89.6	76.9	87.4	90.7	53.3
SCOTT	92.9	96.4	100.0	92.9	92.9	89.3	64.3
SEDGWICK	76.9	89.2	89.5	75.0	90.1	88.6	60.2
SEWARD	76.9	89.9	84.6	74.6	74.6	82.2	45.0
SHAWNEE	85.8	92.9	94.9	83.8	91.4	86.8	55.3
SHERIDAN	90.0	90.0	95.0	90.0	80.0	90.0	25.0
SHERMAN	84.6	96.2	96.2	84.6	88.5	90.4	25.0
SMITH	100.0	100.0	100.0	100.0	92.3	100.0	69.2
STAFFORD	87.2	95.7	97.9	87.2	85.1	89.4	76.6
STANTON	80.0	96.7	93.3	80.0	93.3	86.7	66.7
STEVENS	80.9	88.2	92.6	79.4	86.8	79.4	41.2
SUMNER	83.0	89.5	90.8	81.0	86.9	92.2	26.8
THOMAS	91.8	95.9	93.9	91.8	95.9	95.9	40.8
TREGO	84.2	89.5	89.5	78.9	94.7	94.7	73.7
WABAUNSEE	85.3	91.2	94.1	85.3	97.1	94.1	52.9
WALLACE	94.1	100.0	100.0	94.1	100.0	94.1	76.5
WASHINGTON	95.1	98.4	100.0	95.1	95.1	95.1	65.6
WICHITA	90.9	100.0	100.0	90.9	84.8	97.0	72.7
WILSON	73.0	82.5	90.5	73.0	74.6	85.7	44.4
WOODSON	80.0	82.9	88.6	77.1	94.3	91.4	51.4
WYANDOTTE	68.6	88.1	90.6	65.7	71.8	83.0	46.2

*Based on the retrospective survey for the school year starting 2003.